Leiden econophysics model tested best by central banks

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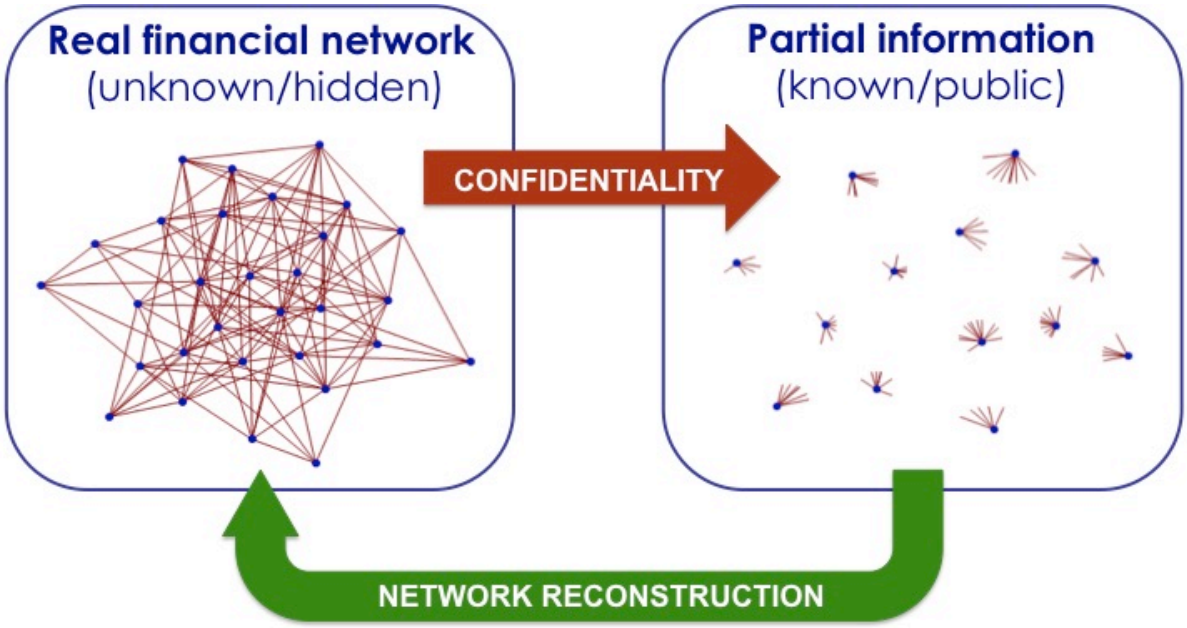

Credit: Leiden Institute of Physics

A full overview of all loans and debts between banks would prevent a new financial collapse. But banks do not provide this information. An econophysics model by Diego Garlaschelli and collaborators reconstructs the most probable situation and finishes first place in two independent tests.

The 2008 financial crisis made abundantly clear how unpredictable and

vulnerable our banking system is. Banks are intertwined in a complex global web of debts and loans, where an initially local financial problem can lead to a cascade of bankruptcies. A detailed map of interbank links worldwide would enable the system to prevent dependencies from becoming too strong. However, banks do not disclose information on who they lend to and borrow from. They are only obliged to disclose their total debit and credit.

Hidden riskiness

For each bank, the lack of knowledge on how its debtors and creditors are connected to the rest of the system often implies a "hidden riskiness." This makes it difficult to decide the interest rate for loans. To circumvent this information deficit, Leiden physicist Diego Garlaschelli and a team of international collaborators built a theoretical model based on statistical physics that calculates the probability of each bank borrowing money from another bank. His model was judged as the best probabilistic model by a collaboration of several central banks and by an independent research group.

Best model

These studies compared the performance of several alternative methods in reconstructing real privacy-protected interbank networks from partial information, and the model by Garlaschelli and collaborators was found the best one in both cases. 'Banks determine the interest rate for loans to other banks based on perceived riskiness,' Garlaschelli explains. 'If bank A has lent much money to bank B, which in turn has lent money to an unstable bank C, then bank A becomes unstable, as well. Our model reflects this, and can be used to estimate hidden risks and calculate more realistic interest rates. Correct rates keep the system stable.'

Old model

The old established model was solely based on the bare numbers for total debit/credit. For instance, to estimate the relation between Rabobank and ING, you multiply Rabobank's total debit with ING's credit and divide by the total sum in circulation worldwide. This creates a network where all banks are connected to each other. However, this ignores the fact that in reality, the majority of relations are non-existent; therefore, those that do exist are much heavier than what the old model predicts. And those links are precisely the ones that can propagate financial distress.

Density of links

Garlaschelli: 'Besides providing a reliable estimate of which banks are connected, our model calculates the most probable weight of each relationship, depending on only one unknown factor—the density of links in the system. And because this number appears to be quite stable inside a country, we can easily proxy it and then make a prediction on which links exist, and how heavy they are. Central banks can use this information to better monitor the financial network and implement policies that prevent local instabilities from inflating into a hazard for the whole system.'

More information: Methods for Reconstructing Interbank Networks from Limited Information: A Comparison DOI: 10.1007/978-3-319-47705-3_15

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